



Biosolids Sampling and Analysis Plan

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City of Everett
Public Works Department
Water Pollution Control Facility





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1. Introduction

The Everett Water Pollution Control Facility (WPCF) is comprised of a parallel treatment system consisting of a Trickling Filter/Solids Contact (TF/SC) process and an Aeration/Oxidation Pond lagoon system. These parallel systems are connected by Aeration Cells 1 and 2.

Biosolids are the treated solids produced by wastewater treatment. Everett employs a biological treatment process that uses endogenous microbes to oxidize organic components of wastewater, including pathogens. Everett's biosolids are composed of organic and mineral particulates that have settled out of the process and contain nutrients, microorganisms, and digested solids which can be utilized in land application as a soil amendment.

The mission of the Everett Biosolids Management Program is to safely and beneficially reuse the biosolids produced at the WPCF. The WPCF Biosolids Management Program also ensures optimal operation of the lagoon system for both biosolids and water treatment.

This document provides information on the WPCF's plan for sampling and analysis of biosolids as required under the Biosolids General Permit.

a. Lagoon Treatment Overview

The WPCF is a combined TF/SC treatment facility and lagoon system used for both solids storage and biological wastewater treatment. The lagoon system consists of two mechanically aerated cells in series (AC1 and AC2) followed by an unaerated Oxidation Pond and a Polishing Pond. The TF/SC plant receives part of its flow from aerated lagoon effluent (ALE). See [Figure 1](#).

AC1 and AC2 are two 14.7-acre lagoons in series, each with a volume of approximately 33.5 million gallons. AC1 receives water from three sources:

1. Secondary clarifier effluent (SCE) in excess of the South Effluent Pump Station discharge,
2. Effluent from the primary clarifiers (PCs) in excess of the process flow through the TF/SC, and
3. Screened and partially de-gritted wastewater from the Headworks (HDWKs), during periods of unusually high flow, when plant influent exceeds the primary clarifier influent maximum.

AC1 uses mechanical aeration to control odor and to move solids from AC1 to AC2; because it is unaerated, solids accumulate at a higher rate in AC2 than AC1. Primary Clarifier Sludge (PCS) and Waste Secondary Sludge (WSS) are introduced to AC1 or AC2 through ports 1-6. Ports 1-5 may be used to discharge both PCS and WSS. By design, Port 6 can discharge only WSS. By selecting the discharge ports, plant staff can introduce solids at different points in the aeration cells. Port selection, along with aerator locations, encourages solids to deposit and stabilize in AC2.

Between dredging events, ports 5 and 6 are typically used. Two months prior to dredging, PCS and WSS discharges are eliminated at AC2 and shifted to ports in AC1, typically port 2. By discharging solids in AC1, newer and less treated solids are prevented from mixing with the solids that have been stabilizing in AC2. Solids are dredged from AC2 typically every three years.



Following AC2, wastewater flows through the Recirculation Channel to the 130-acre Oxidation Pond and the 25-acre Polishing Pond for further treatment, followed by disinfection and discharge to the Snohomish River.

Figure 1 - Aerated Lagoon (AC 1 and 2)





b. Solids Management at the WPCF

The WPCF has traditionally managed its biosolids program using a combination of contracted services and City staff. The City contracts the removal and disposal of biosolids annually from AC2, Oxidation Pond, or Recirculation Channel on a rotating basis. Solids dredged from AC2 and the Recirculation Channel are expected to meet Class B standards and are land applied. However, legacy solids from the Oxidation Pond are historically higher than Table 3 Pollutant Concentration Limits ([WAC 173-308-160](#)) in lead and are disposed of in a Subtitle D landfill (see [Table 1](#)).

Table 1 - Allowable Biosolids Pollutants and Loading Rates (Derived from Biosolids Pollutant Limit WAC)

Pollutant	WAC 173-308-160 Table 1 Ceiling Concentration Limits	WAC 173-308-160 Table 2 Cumulative Pollutant Loading Rates	WAC 173-308-160 Table 3 Pollutant Concentration Limits
Arsenic	75 mg/kg	41 kg/ha	41 mg/kg
Cadmium	85 mg/kg	39 kg/ha	39 mg/kg
Copper	4300 mg/kg	1500 kg/ha	1500 mg/kg
Lead	840 mg/kg	300 kg/ha	300 mg/kg
Mercury	57 mg/kg	17 kg/ha	17 mg/kg
Molybdenum	75 mg/kg	Not applicable	Not applicable
Nickel	420 mg/kg	420 kg/ha	420 mg/kg
Selenium	100 mg/kg	100 kg/ha	100 mg/kg
Zinc	7500 mg/kg	2000 kg/ha	2000 mg/kg

(Reproduced from the General Permit)

In 2019, the City of Everett (COE) purchased a site called Marshland located in southeastern Everett for the purpose of land application. However, since Everett uses a bid process to select its final disposal site for biosolids, the application sites vary from year to year. Marshland is leased by Snohomish Valley Farms; they bid on hauling and applying biosolids to the City property. Soil sampling at Marshland is taken by the Industrial Pretreatment group every spring and after crop cutting in years biosolids were applied to the site. For more information on Marshland sampling, see [Section 3. c](#).

Hydrographic surveys of the lagoons created by City staff assist in tracking of the quantity and distribution of biosolids prior to and after contract dredging. Plant operations staff use a Garmin device to take depth data and a sludge judge to take density samples from a boat on the lagoons. The CAD division then uses that data to produce hydrographic surveys as in [Appendix F](#). Surveys of the AC2, Oxidation Pond, and Recirculation Channel are taken in September of each year, and after an area is dredged.



In 2021, a small area of AC2 was found to have a lower pond bottom than what was designed. To track any potential changes to the pond bottom, Ecology has requested a pond bottom survey be completed after dredging projects. Pond bottom surveys are conducted by City Staff using a Garmin device to mark GPS coordinates and take depth data using a rigid, incremented pole. The manual depth measurements and Garmin coordinates are compiled by City Staff and forwarded to the CAD division to produce bottom surveys similar to the hydrographic surveys. Any remarkable depths are called out by City Staff and will be marked on the bottom survey for further review or liner sampling to verify the liner is intact.

c. Biosolids Pond Sampling Overview

The concentrations of nutrients, pathogens, and pollutants in biosolids vary over time and by location in the WPCF Ponds. The testing in this document was designed to follow Ecology regulations and to help plan for contract dredging removals and disposal.

Chemical analysis of [40 CFR part 503](#) regulated metals, vector attraction reduction (VAR), and pathogen reduction provide the basis for establishing Class B biosolids. Nutrient concentrations determine agronomic rates when biosolids are land applied. All chemical analysis of biosolids follow the methods outlined in [WAC 173-308-140](#).

Everett produces approximately 2,000 dry tons of biosolids annually, which sets sampling per [WAC 173-308-150](#) at six times per year. However, because solids removals only occur during the annual dredging project, Ecology has agreed that sampling is only required annually on the dredged solids. For overall tracking, the COE Biosolids Program will test the three dredging locations more frequently. Legacy solids within the Oxidation Pond have been surveyed, sampled, and characterized, and will be sampled on an annual basis. The characterization of solids within AC2 have been shown to be consistent in meeting Class B and [Table 3](#) standards and will be sampled twice a year. Historically, the Recirculation Channel has been sampled with the Oxidation Pond. As the Recirculation Channel is closer in quality to AC2 solids than the Oxidation Pond legacy solids and are expected to be land applied, solids from the Recirculation Channel will also be sampled biannually. A summarized timeline of all ponds and biosolids sampling is shown below in [Table 2](#).

Samples will be tested for the pollutants listed in section [WAC 173-308-160](#), pathogen reduction per [WAC 173-308-170](#), and vector attraction reduction per [WAC 173-308-180](#). See [Appendix E](#) for the Environmental Protection Agency's Priority Pollutant List, and [Section 2](#) for a list of the specific analytes for biosolids testing.

See process schematic in [Appendix A](#), and sampling locations and analytes in [Appendix B](#).



Table 2 – Schedule of Biosolids and Pond Sampling

Month	Type of Sampling	Location	Frequency	Required By/For	Notes
January	Metals, TS, Pathogens	AC2	Biannually (1/2)	GBP*, AR** at pond to be dredged, Pond Monitoring for other	Samples taken within 30 days of start of dredging contract (at dredging contract pond only)
	Metals, TS, Pathogens	Recirc. Channel	Biannually (1/2)		
February – Contract Dredging Project					
February - March	Solids Nutrient Sampling	Biosolids Pad	Annually (1/1)	GBP, Hauling and Application Bid & SSLAP	Sample dewatered solids from dredging contract
April	Marshland Soil Sampling	Marshland Site	Biannually (1/2)	COE Marshland Soil SAP	Approximate date, after dredging project is complete
	Pond Solids Survey	Dredged area	Post dredging	Pond Monitoring	
	Pond Bottom Survey	Dredged area	Post dredging	Requested by Ecology	
May – Contract Hauling and Application					
August	Pond Bottom Survey	AC2	Annually (1/1)	Requested by Ecology	
	Pond Bottom Survey	Recirc Channel	Annually (1/1)	Requested by Ecology	
	Pond Bottom Survey	Oxidation Pond	Annually (1/1)	Requested by Ecology	
	Metals, TS, Pathogens	AC2	Bi-annually (2/2)	Pond Monitoring	Results used in dredging bid for the subsequent year at relevant pond
	Metals, TS, Pathogens	Recirc. Channel	Bi-annually (2/2)	Pond Monitoring	
	Metals, TS, Pathogens	Oxidation Pond	Annually (1/1)	Pond Monitoring	
September-October	Pond Solids Survey	AC2	Annually (1/1)	Dredging Bid	Results used in dredging bid for the subsequent year at relevant pond
	Pond Solids Survey	Recirc Channel	Annually (1/1)	Dredging Bid	
	Pond Solids Survey	Oxidation Pond	Annually (1/1)	Dredging Bid	
	Marshland Soil Sampling	Marshland Site	Biannually (2/2)	COE Marshland Soil SAP	Approximate date, after crop cutting on each individual field
December	VAR	Dredging Project Location	Annually (1/1)	GBP, AR	Samples taken within 60 days of start of dredging contract (at dredging contract pond only)

*GBP – 2022 Statewide General Permit for Biosolids Management (General Biosolids Permit)

**AR – Biosolids Annual Report

	Metals, Total Solids, and Pathogen Sampling
	Nutrient Sampling on Dredged and Dewatered Biosolids
	Marshland Soil Sampling
	Pond Survey
	Vector Attraction Reduction Sampling



2. Biosolids Sampling Analysis & Laboratory

COE biosolids in the lagoons are sampled for the following:

- 9 priority metals (As, Cd, Cu, Pb, Hg, Mo, Ni, Se, Zn)
- Fecal Coliform
- Total Solids
- VAR

COE biosolids that have been dredged are sampled for the following:

- Total Solids
- Nitrite/Nitrate
- Total Kjeldahl Nitrogen (TKN)
- Ammonia
- pH

Everett Environmental Laboratory (EEL) is the onsite lab accredited by the Department of Ecology for the following:

- Total Metals – per [EPA method 6020B](#)
 - Arsenic
 - Cadmium
 - Copper
 - Lead
 - Molybdenum
 - Nickel
 - Selenium
 - Zinc
- Mercury – [EPA method 7471B](#)
- Fecal Coliform – SM9221 B+E1+C
- Solids, Total, Fixed and Volatile – SM2540G
- pH – [EPA method 9045D](#)
- VAR



Analytical Resources Incorporated (ARI) is an independent and Ecology accredited laboratory located in Tukwila that is used for:

- Nutrients
 - Nitrite/nitrate
 - Ammonia
 - TKN
- TCLP Metals – if needed for disposal purposes

3. Biosolids Sampling

a. Sampling in situ biosolids for metals, VAR, and Pathogens

In situ sampling is completed in the AC2, Recirculation Channel, and Oxidation Pond to monitor metals and pathogen density. VAR testing is completed at least 40 days prior to contract start date in February to accurately test the area to be dredged, dewatered, and hauled. Samples for metals, pathogens (fecal coliform), and total solids are taken twice a year in AC2 and Recirculation Channel. Samples taken in August/ September are provided to contractors who bid on that year's dredging project. Samples taken in January represent the area to be dredged, dewatered, and hauled.

Sampling for metals, fecals, and total solids takes 3 days in the Oxidation Pond, 2 days in AC2, and 1 day in the Recirculation Channel. VAR must be sampled on a separate day from fecal sampling due to EEL laboratory constraints.

The full SOP for In -Situ Biosolids Sampling is linked.

b. Sampling dewatered biosolids for fecal coliforms and nutrients

Dewatered biosolids have the potential for pathogen regrowth. In addition to sampling in-situ biosolids, fecal coliform sampling is conducted after dewatering and before land application. This ensures biosolids meet regulatory requirements for pathogen reduction.

Biosolids are stockpiled at the northwest end of the biosolids pad delineated by ecology block walls. About 2,000 dry tons of solids fit in this area.

Fecal coliform testing:

- 1) On the Monday immediately following the start of dredging operations, existing piles are sampled in seven locations for fecal coliforms. Samples are taken instantaneously and delivered to EEL within the holding period.
- 2) One week later and every following Monday, another seven fecal coliform samples are taken. These samples are taken from the following locations:
 - A) Two samples are from piles already sampled for fecal coliforms.
 - B) Five samples are from piles or bunkers not already sampled.
- 3) Sampling for fecal coliforms continues until dredging is complete.



- 4) If results of fecal coliform sampling result in concentrations equal to or less than the results from in-situ sampling, regrowth is considered to be minimal and sample frequency for Step 2 may be reduced to once every two weeks.

Nutrients testing:

Nutrient sampling of biosolids for agronomic rate determination is most representative if the samples are collected from dewatered biosolids. Dewatered biosolids are tested for nutrients every 200 dry tons (+/-) produced. Dry weight of dewatered biosolids tonnage is calculated on a running basis based on net truck weight and solids content.

- 1) For nutrient analysis, four samples per 200 dry tons are taken and composited together for analysis.
- 2) Samples for nutrients may be taken simultaneously with samples for % TS. As part of the dredging and dewatering process, each truckload is sampled for percent total solids (% TS) when it is weighed. Samples are stored according to the test procedure until four samples have been taken. Once % TS sampling complete, the set of four samples are composited and sent to ARI for nutrient analysis.
- 3) If biosolids are stockpiled before nutrient sampling can occur, the City will follow its sampling SOP for sampling soil piles at its solid waste handling facility.

c. Marshland Soil Sampling and Agronomic Rates

The Marshland site is owned by the City of Everett and leased to Snohomish Valley Farms (SVF) for the purpose of land application of Everett's Class B biosolids. Soil samples are taken each Spring and after crop cutting in years biosolids are applied. Samples measure nitrate, nitrite, ammonia, TKN, and pH in the soil. For sampling methods, see the specific Marshland Soil Sampling and Analysis Plan.

City of Everett biosolids that are land applied must meet Class B and [Table 3](#) limits. To preserve the lifetime of the City owned application site, biosolids with pollutant concentrations that would require recording accumulative loading to the site will be landfilled in a Subtitle D facility.

The amount of biosolids that can be applied depend on the nutrient concentrations in the dewatered biosolids and a site-specific agronomic rate based off the planned crop and site conditions. Marshland is divided into two fields, the East Field and the West Field by the Marshland Canal. Each field is sampled separately as they may be planted with different crops and have different agronomic rates.

The Site Specific Land Application Plan (SSLAP) documents the calculated application rates and application methods for an application site. The Marshland SSLAP is written and submitted to DOE by the City of Everett in coordination with Snohomish Valley Farms. As part of the biosolids hauling and land application bid, each bidder is required to submit a SSLAP for their proposed site. The low bidder submits and obtains approval directly for application onto their site by the Ecology Regional Biosolids Coordinator. Any remaining biosolids over the calculated and approved application amount as permitted by Ecology go to the next lowest bidder and their proposed site.

Marshland spring soil sampling is scheduled annually in April to track and determine appropriate application rates for the East and West Fields. After a baseline application rate has been determined for



each field, this sampling may be abridged to only application years. Sampling is scheduled in April to allow the site to dry from wet weather conditions and to be representative of the soil at the time of application. Sampling methods require the water table to be lower than a foot down, so any sample site that is not sampled due to high water table is marked and recorded.

The Department of Ecology requires soil samples to be taken after crop cutting after a season of application of biosolids to monitor the crop uptake of nutrients. A second-round soil sampling will be scheduled by the COE Biosolids Manager on each field once crop cutting has been completed by Snohomish Valley Farms.

The timeline of Marshland sampling and application is below:

February	COE – WPCF Operations Sample dewatered biosolids on Biosolids Pad
March	COE – Biosolids Manager Calculate application rates of each field at Marshland, write SSLAP, and submit as part of SVF's Hauling Bid COE – Procurement COE Biosolids Hauling and Application Project bid opening COE – Biosolids Manager If SVF is low bidder, submit SSLAP to Ecology
April	COE – IPT Marshland soil sampling
May	SVF Hauling off Biosolids Pad and application on Marshland
May/June	SVF Tilling & planting Marshland
September/ October	COE – IPT Marshland soil sampling



4. Data Analysis Review

Recordkeeping and reporting will be per [WAC 173-308-290](#) for land application recordkeeping and [WAC 173-308-295](#) for Annual Reports. All required records and analytical data will be kept for a minimum of five years.

Site Specific Land Application Plans with the location, acres applied, date applied, vegetation type, application amount, and sample data are kept in a site-specific land application file created for each application site.

Quality data of biosolids removed from the Ponds is submitted to Ecology with the Annual Report as required under [WAC 173-308-295](#).

5. Everett Biosolids Management Staff

For more information on this plan, please contact Hanna Lintukorpi at 425-257-8946, hlintukorpi@everettwa.gov.

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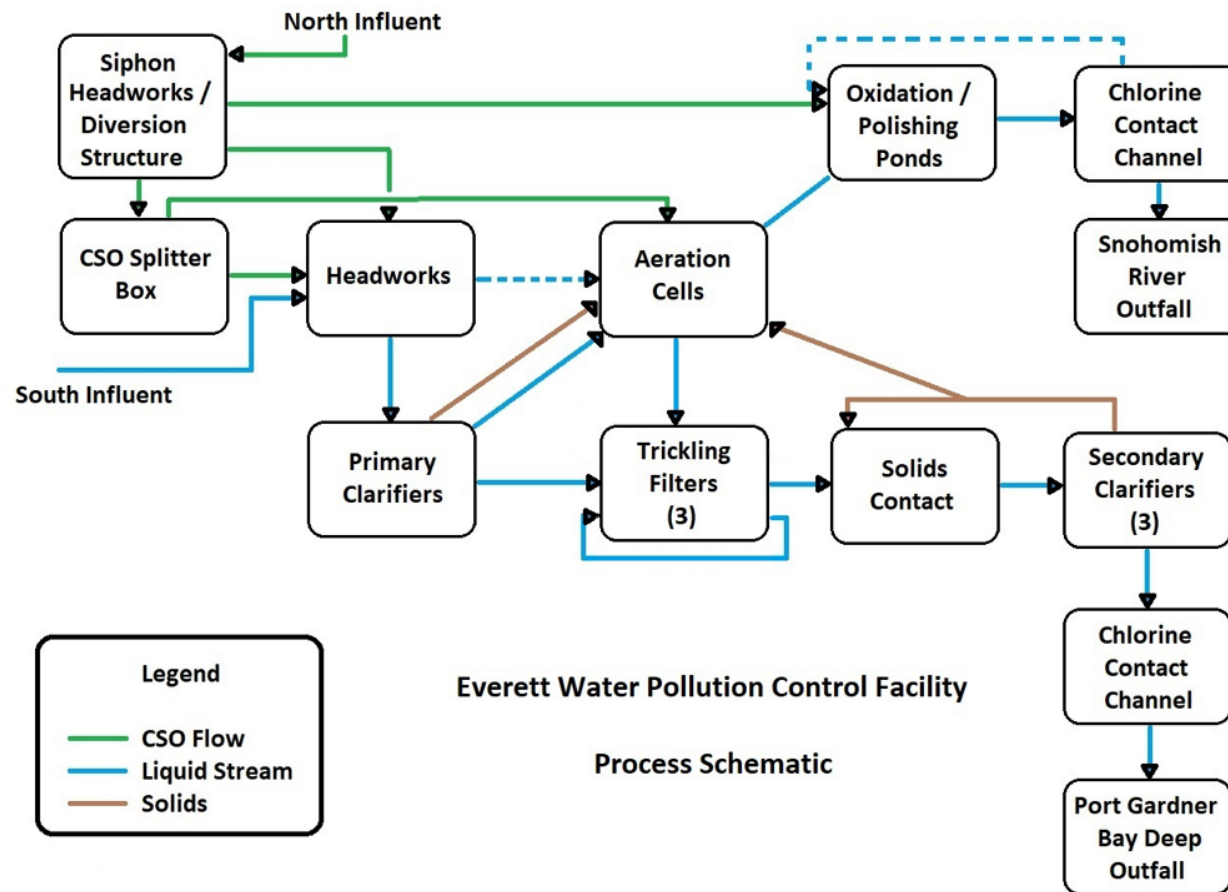
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Appendix A – Process Schematic

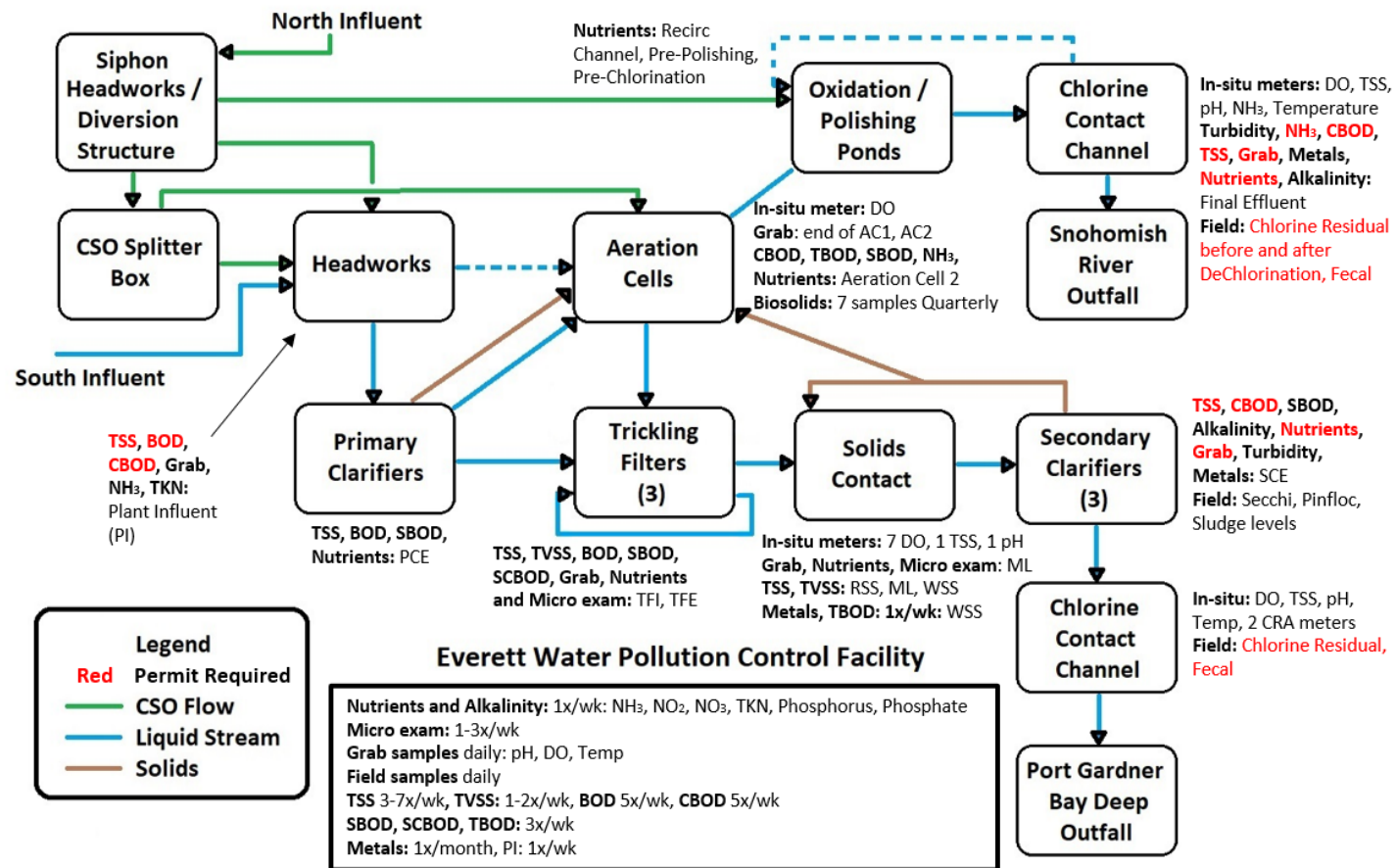
Everett Water Pollution Control Facility Process Schematic





Appendix B – Process Schematic with Sampling Locations and Types

Everett Water Pollution Control Facility Process Schematic with Samples



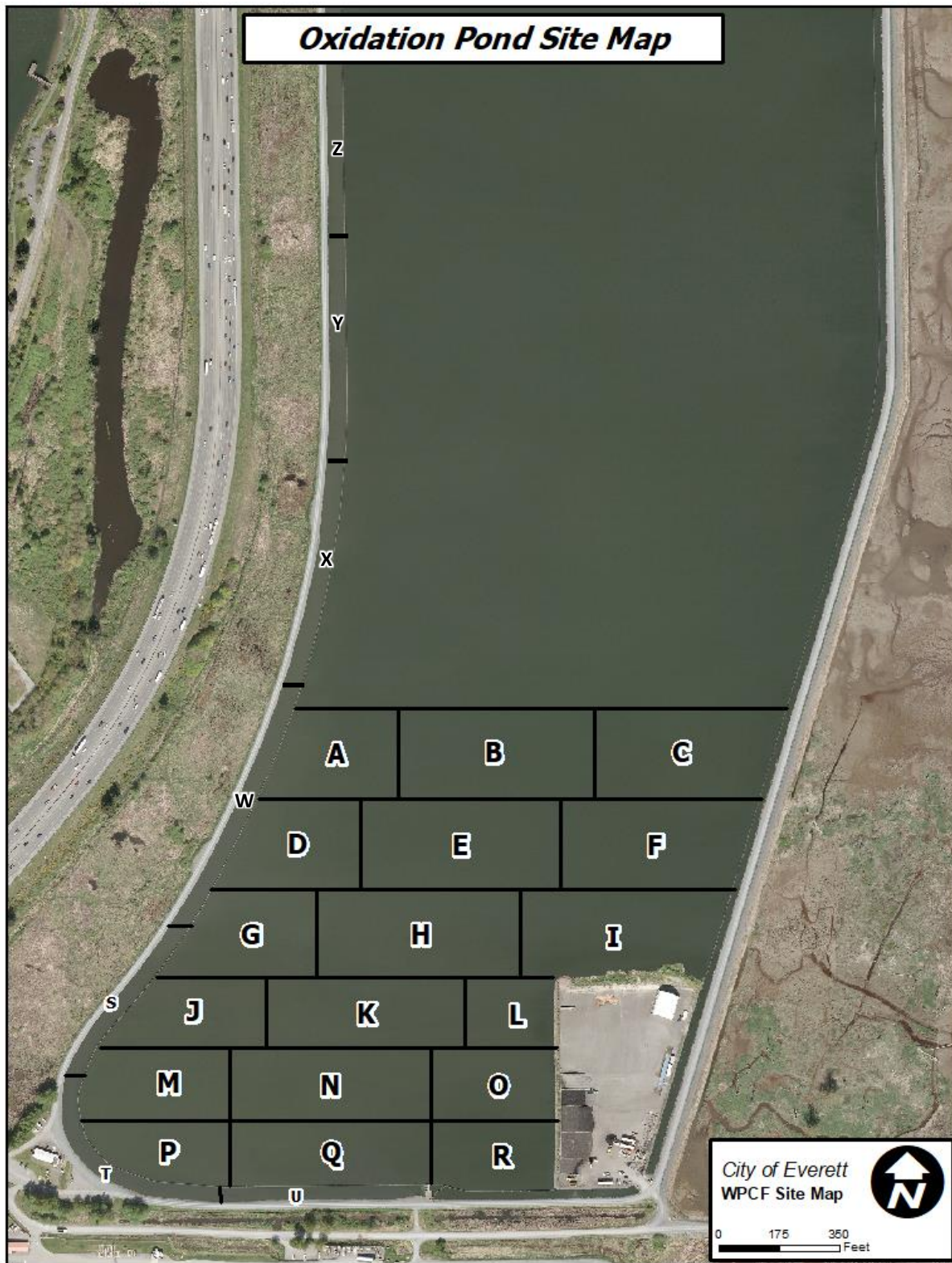


Appendix C – Aeration Cell 2 Sample Site Map





Appendix D – Oxidation Pond Site Map





Appendix E – Analysis Methods, Preservation and Holding Times

(Reproduced from the General Permit – Table 3)

Parameter	Methods	Basic Preservation	Maximum Holding Time
Arsenic	SW-846 6010 SW-846 6020 SW-846 7010 SW-846 7061	Cool to ~4° C	6 months
Cadmium	SW-846 6010 SW-846 6020 SW-846 7000 SW-846 7010	Cool to ~4° C	6 months
Copper	SW-846 6010 SW-846 6020 SW-846 7000 SW-846 7010	Cool to ~4° C	6 months
Lead	SW-846 6010 SW-846 6020 SW-846 7000 SW-846 7010	Cool to ~4° C	6 months
Mercury	SW-846 7470 SW-846 7471	Cool to ~4° C	28 days
Molybdenum	SW-846 6010 SW-846 6020 SW-846 7000 SW-846 7010	Cool to ~4° C	6 months
Nickel	SW-846 6010 SW-846 6020 SW-846 7000 SW-846 7010	Cool to ~4° C	6 months
Selenium	SW-846 6010 SW-846 6020 SW-846 7010 SW-846 7741	Cool to ~4° C	6 months
Zinc	SW-846 6010 SW-846 6020 SW-846 7000 SW-846 7010	Cool to ~4° C	6 months
Total Kjeldahl Nitrogen (TKN)	SM 4500, Norg B SM 4500, Norg C ASTM D3590-89 ASTM D3590-02	Cool to ~4° C	28 days
Nitrate-nitrogen	EPA 353.2 SM 4500-NO3 E, F, or H	Cool to ~4° C	28 days
Ammonia-nitrogen	SM 4500-NH3 B + C, D, E, or G	Cool to ~4° C	28 days
Organic Nitrogen	Calculated: TKN minus NH3-N	Not applicable	Not applicable



Appendix F – Hydrographic Survey for EWPCF, December 2022

